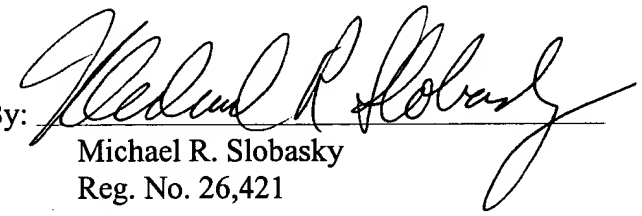
REMARKS

In view of the above amendments, favorable consideration in this application is respectfully requested. By this Amendment, claims 1-25 have been canceled without prejudice or disclaimer and new claims 26-61 have been added. Claims 26-61 remain in the application, with claims 26 and 46 being independent.

Based upon the foregoing amendments and remarks, it is respectfully submitted that the present application is in condition for examination. Should the Examiner have any questions or comments, the Examiner is cordially invited to telephone the undersigned attorney.

Respectfully submitted,

JACOBSON HOLMAN PLLC

By: 

Michael R. Slobasky
Reg. No. 26,421

400 Seventh Street, N. W.
Washington, D.C. 20004
Telephone: (202) 638-6666
Atty. Docket No.: P66710US0
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MRS:cwp
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CLAIMS

1. Micro cellular polyhipe polymer scaffold suitable for growth of living matter for biomedical applications,
comprising a homogeneous cross linked open cellular material defined by a bulk polymer matrix having a surface and an interface with an internal phase, and having porosity greater than 75% comprising emulsion derived pores of diameter in the range of 0.1 to 10,000 micron and emulsion derived pore interconnects of diameter in the range of up to 100 micron, wherein the scaffold comprises a plurality of discrete and/or interpenetrating zones:
at the polymer surface;
within its bulk matrix;
at the interface between polymer and internal phase; and/or
between adjacent but distinct pores and/or interconnects,
characterised by form and dimension of pore and interconnect type within each zone, and location of zones wherein adjacent or interpenetrating zones are distinguished by boundaries which may be between or contained within adjacent pores and/or interconnects in respective zones, whereby zones are suitable for regulating positioning and/or morphology of living matter
comprising controlled pore sizes in the range up to 0.5 μm, up to 300 μm, up to 10,000 μm, and/or up to nm size and comprising pore interconnects in the range up to 100 micron, and/or approaching 500 micron
with the proviso that in the case that pore type is present having size in the range 1 – 50 micron, at least one additional pore type is present in a range as herein defined other than 1 – 50 micron.

2. Microcellular polyhipe polymer scaffold according to Claim 1 obtainable by polymerising a high internal phase emulsion of an immiscible dispersed phase in a continuous phase, wherein the dispersed phase is void or contains

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dissolved or dispersed materials, and (co)monomers, oligomers and/or pre-polymers are present in the continuous phase, by means of introducing the dispersed phase by controlled dosing into the continuous phase with controlled mixing at controlled temperature and rate to achieve an emulsion of controlled pore size, and subsequently homogenising for controlled period under controlled deformation and polymerising under controlled temperature and pressure,

characterised in that controlled pore size up to 0.5 μm is obtained using very high deformation rate flows in which the flow is predominantly extensional and low emulsification temperature, pore size up to 300 μm is obtained using rate just above the critical deformation rate at which phase inversion takes place and high emulsification temperature, very large pore size up to 10,000 μm is obtained through the method of controlled pore coalescence during polymerisation, and nano-pore size up to nm is obtained through solvent extraction after polymerisation; and in that controlled interconnect diameter up to 500 micron is obtained by polymerising about a 3D network of fibres.

3. Microcellular polyhipe polymer scaffold according to Claim 1 *or 2* suitable for growth of living matter selected from cells, micro-organisms such as bacteria and virus and mixtures thereof.

4. Microcellular polyhipe polymer scaffold as claimed in any of Claims 1 to 3 comprising micro channels formed of pores with interconnects suitable for providing communication and penetration of living matter for anisotropic (directional) growth thereof.

5. Microcellular polyhipe polymer scaffold as claimed in any of Claims 1 to 4 wherein the walls of the micro-channels are (bio)degradable suitable for fusion of living matter in the (bio)degraded scaffold.

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6. Microcellular polyhipe polymer scaffold as claimed in any of Claims 1 to 5 comprising in individual zones, pore and interconnect sizes in different ranges, suitable for co-culturing two or more types of living matter.

7. Microcellular polyhipe polymer scaffold as claimed in any of Claims 1 to 6 wherein ratio of interconnect to pore diameter is in the range $0 < d/D < 0.5$, preferably in the range $0.1 < d/D < 0.5$ when the pore diameter is approximately less than 200 micron

8. Microcellular polyhipe polymer scaffold as claimed in Claim 7 comprising extensive networks of elongate micro capillaries obtainable by moulding about fibrous inserts of diameter as low as 10 micron, throughout the scaffold or zones thereof, separated by the microcellular polymer wherein microcapillaries are suitable for blood or nutrient supply channels, expression channels for living matter and seeding of living matter.

9. Microcellular polyhipe polymer scaffold as claimed in any of Claims 7 and 8 wherein the interface between a microcapillary wall and the bulk polymer provides a thin surface layer of the order of 0.5-5 micron, forming a zone particularly suited for directional (anisotropic) growth of living matter.

10. Microcellular polyhipe polymer scaffold as claimed in Claim 9 as dependent on Claim 3 wherein the interface has smaller pore size than the bulk polymer wherein the zone is suitable for growth of cells forming a lining, for example cells lining the blood vessels or for growing endothelial cells on the interface surface.

11. Microcellular polyhipe polymer scaffold as claimed in any of Claims 1 to 10 comprising a module of shell and tube type or cubic/polyhedric type with respect to direction and/or configuration of channels and/or microcapillaries.

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12. Microcellular polyhipe polymer scaffold as claimed in any of Claims 1 to 11 comprising a surface coating, using coating materials introduced *in situ* during polymerisation or post polymerisation

13. Microcellular polyhipe polymer scaffold as claimed in any of Claims 1 to 12 wherein polymer is selected from proteins and cellulose, polyacrylamide, polyvinyl in rigid or flexible form, poly(lactic acid), poly(glycolic acid), polycaprolactone, poly (lactide/glycolide) and polyacrylimide.

14. Microcellular polyhipe polymer scaffold as claimed in any of Claims 1 to 13 wherein polymer comprises resiliently deformable or elastic material or is rendered resiliently deformable or elastic and is suitable for repeated stress and relaxation by means of oscillatory straining of the scaffold during cell growth facilitating rate of cell growth.

15. Microcellular polyhipe polymer scaffold as claimed in any of Claims 1 to 14 wherein polyhipe scaffold is electrically conductive or is rendered electrically conductive whereby it is suitable for conducting an electric current during cell growth, facilitating distinguishing certain cell types and promoting growth and fusion of particular cell types

16. A process for the preparation of a microcellular polyhipe polymer scaffold as hereinbefore defined comprising in a first stage the formation of a high internal phase emulsion (HIPE) of an immiscible dispersed phase in a continuous phase, wherein the dispersed phase is void or contains dissolved or dispersed materials, and (co)monomers, oligomers and/or pre-polymers are present in the continuous phase, by means of introducing the dispersed phase by controlled dosing into the continuous phase with controlled mixing at controlled temperature and rate to achieve an emulsion of controlled pore size,

and subsequently homogenising for controlled period under controlled deformation and polymerising under controlled temperature and pressure.

17. Process as claim in Claim 16 wherein controlled pore size of emulsions up to 0.5 μm are obtained using very high deformation rate flows, pore size up to 300 μm are obtained using rate just above the critical deformation rate at which phase inversion takes place, very large pore size up to 10,000 μm are obtained through the method of controlled pore coalescence during polymerisation, and nano-pore size up to nm are obtained through solvent extraction after polymerisation.

18. Process as claimed in Claims 16 or 17 comprising co-extrusion of polyhipe emulsions of differing pore and interconnect sizes eg concentrically or side-by-side.

19. Process as claimed in Claims 16 to 18 wherein the emulsion comprises aqueous and non-aqueous phases, preferably aqueous and oil.

20. A biologically active system comprising a polyhipe scaffold as defined in any of Claims 1 to 15 and living matter providing normal cell functioning associated with a natural biologically active system present in the human or animal body, wherein living matter is selected from microorganisms or multiple cells selected from human, animal and plant cells, preferably selected from isotropic tissue and bone cells present in cartillage, cornea, marrow and the like, anisotropic cells such as nerve, muscle, blood vessel cells, of cell type selected from fibroblasts, chrondocytes, osteoblasts, bone marrow cells, hepatocytes, cardiomycytes neurons, myoblasts, macrophages and microvascular endothelium cells.

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21. Method for growth of multiple cells in a polyhipe scaffold as hereinbefore defined in any of Claims 1 to 15 comprising providing cells on or in the scaffold in a controlled environment and providing a suitable nutrient adapted for growth and providing conditions for growth promotion and positional control.

22. Use of a biologically active system as defined in Claim 20 as an implant or in association *in vivo* in or with the human or animal body or as a module for *in vitro* studies mimicking a part of the human or animal body or for use in a growth environment, for example for the growth of organ cells in the cell side of the module in order to stimulate organs.

23. An organ support module comprising a cubic or polyhedric module of closely interwoven but not interconnecting channels immersed in a polyhipe scaffold as defined in any of Claims 3 to 15 suited for growth of specific organ cells in the polyhipe and/or the channels, wherein cells are optionally in contact with a specific microchannel and all cells are capable of intercell communication.

24. A method for manufacturing an organ support module as defined in Claim 23 comprising providing a polyhipe emulsion, providing a mould including inserts such as rods or fine fibres, pumping polyhipe emulsion and optional filler into the mould about the inserts and polymerising, with subsequent removal of inserts and optional filler to provide pores and interconnects, microcapillaries and nano pores in desired configuration.

25. The use of a polyhipe scaffold, a biologically active system, or organ support module as defined in any of Claims 1 to 15, 20 and 23 for the manufacture of contact lenses, dental fillings, cochlea implants, vascular

supports including heart valves and cardiac pace makers and drug delivery skin patches.

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